

Attorney Reference: A3-268 US

MEMORY CARD CONNECTOR

Field of the Invention:

This invention generally relates to the art of electrical connectors and, particularly, to a memory card connector.

Background of the Invention:

Memory cards are known in the art and contain intelligence in the form of a memory circuit or other electronic program. Some form of card reader reads the information or memory stored on the card. Such cards are used in many applications in today's electronic society, including video cameras, digital still cameras, smartphones, PDA's, music players, ATMs, cable television decoders, toys, games, PC adapters, multi-media cards and other electronic applications. Typically, a memory card includes a contact or terminal array for connection through a card connector to a card reader system and then to external equipment. The connector readily accommodates insertion and removal of the card to provide quick access to the information and program on the card. The card connector includes terminals for yieldingly engaging the contact array of the memory card.

The memory card connector often is mounted on a printed circuit board. The memory card, itself, writes or reads via the connector and can transmit between electrical appliances, such as a word processor, personal computer, personal data assistant or the like.

Some memory card connectors are provided with a write-protection function by means of a pair of elastic conductive terminals forming a controlling switch. The two elastic terminals are mounted at a side of the connector and have respective elastic arms arranged in close proximity to each other and may or may not be moved into mutual engagement by the memory card to close the controlling switch.

When switching off the write-protection switch, the memory card pushes one of the elastic arms of the switch into engagement with the other elastic arm for electrically connecting the arms. This allows signals to be transmitted between the memory card and the printed circuit board.

When switching on the write-protection switch, the memory card may have a void or recess which will not push the one elastic arm into engagement with the other elastic arm. With the two elastic arms separated, signals cannot be transmitted between the memory card and the printed circuit board.

Unfortunately, problems continue to be encountered with memory card connectors which have such a write-protection function. Specifically, the switch terminals typically are simply mounted in the connector by barbs or an interference force fit, alone. When the memory card is

repeatedly inserted into and pulled out of the connector, the elastic terminals become loose and often do not make proper contact. The present invention is directed to solving these problems.

Summary of the Invention:

An object, therefore, of the invention is to provide a new and improved memory card connector of the character described and having at least a pair of switch terminals mounted on the connector housing.

5 In the exemplary embodiment of the invention, the connector has an interior cavity for receiving a memory card. An insulative housing has a rear terminal-mounting section at the rear of the cavity. A longitudinal side wall section extends forwardly from one end of the rear section at one side of the cavity. The housing is mountable on a circuit board. A plurality of terminals are mounted on the rear terminal-mounting section of the housing and have contact portions for
10 engaging appropriate contacts on the memory card. A pair of switch terminals are mounted on the side wall section of the housing. One switch terminal has an elastic contact arm which may be engageable by the memory card received in the cavity and movable into engagement with a contact arm of the other switch terminal. Complementary interengaging mounting means are provided between at least one of the switch terminals and the longitudinal side wall section of the
15 housing and includes an L-shaped locking boss at an outside of the side wall section defining a locking space behind the boss. The at least one switch terminal has an opening in a body portion thereof through which the locking boss can be inserted to position the body portion in the locking space behind the boss and prevent the body portion from pulling outwardly of the side wall section. A soldering tab projects from a bottom edge of the body portion for solder connection to
20 the circuit board.

As disclosed herein, both switch terminals have body portions with the openings therein and engageable with a pair of the L-shaped locking bosses on the side wall section. Both switch terminals have soldering tabs projecting outwardly from bottom edges of the body portions. The contact arms of both switch terminals are elastic.

25 According to one aspect of the invention, the at least one switch terminal has a locking tab projecting from the body portion and into engagement with a locking shoulder on the side wall section to prevent the body portion from pulling upwardly of the side wall section. In the preferred embodiment, the locking tab is stamped and bent from a top edge of the body portion. As disclosed herein, the body portion is engaged in a retaining slot in the side wall section, and
30 the locking tab is snappingly engaged with a pair of the locking shoulders at opposite sides of the retaining slot as the body portion is inserted into the slot.

According to another aspect of the invention, the elastic contact arm of the one switch terminal is at one end thereof adjacent the longitudinal side wall section of the housing. A second elastic contact arm is at an opposite end of the terminal adjacent the rear terminal-mounting section of the housing for engaging a third switch contact in response to insertion of the memory card into the cavity. The terminal is generally L-shaped to define the two elastic contact arms.

Other features of the invention include the opening in the at least one switch terminal extending along the body portion thereof through a juncture between the body portion and the soldering tab. The locking boss is located on the outside of a mounting post projecting downwardly from the side wall section. The body portion includes barbs engageable with the side wall section in the retaining slot.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

Brief Description of the Drawings:

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction
5 with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIG. 1 is an exploded perspective view of a memory card connector embodying the concepts of the invention;

FIG. 2 is a perspective view of the connector in assembled condition;

10 FIG. 3 is an enlarged side elevational view of the connector, with the cover removed; and

FIG. 4 is an enlarged top plan view of the connector, with the cover removed.

Detailed Description of the Preferred Embodiment:

Referring to the drawings in greater detail, the invention is embodied in a memory card connector, generally designated 10 (FIGS. 1 and 2), which includes a housing, generally designated 12, and a cover, generally designated 14, along with a plurality of terminals, generally designated 16, mounted on the housing. The housing is fabricated of insulating material such as molded plastic, and the cover is fabricated of metal such as stamped and formed sheet metal material.

The cover and the housing combine to form an interior card-receiving cavity 18 having an open mouth 18a at a front receptacle area of the connector. The mouth permits insertion and removal of a memory card into and out of cavity 18.

The molded plastic insulating housing 12 of connector 10 may be generally U-shaped (as shown) or L-shaped (not shown). In either event, the housing has a rear terminal-mounting section 20 which traverses the rear of cavity 18, along with a longitudinal side wall section 22 (and 24) which extends forwardly from one or both ends of the rear section to define one or both sides of cavity 18. The housing includes a bottom plate 26, and the overall housing has a bottom surface 28 for mounting on top of a printed circuit board (not shown). Side wall section 22 has first and second narrow slots 30 and 32, respectively, which open at the top of the side wall section. The rear terminal-mounting section 20 has first and second narrow slots 34 and 36 which open at the top thereof. Side wall section 22 has a pair of depending mounting posts 22a, and side wall section 24 has a pair of depending mounting posts 24a (only one being visible in the drawings). An L-shaped locking boss 39 projects outwardly from the outside of each mounting post 22a and defines a locking space or slot 39a behind the boss.

Terminals 16 are mounted within a plurality of through passages 38 (FIG. 1) in rear terminal-mounting section 20 of the housing. Each terminal includes a tail portion 40 generally flush with bottom surface 28 of the housing for connection, as by soldering, to appropriate circuit traces on the printed circuit board. Terminals 16 also have contact portions 42 for engaging appropriate contacts on the memory card, such as at the bottom of the card.

Cover 14 of connector 10 includes a top wall 44, a depending rear wall 46 and depending side walls 48. Top wall 44 substantially covers the entire terminal contact array of the connector. Rear wall 46 depends downwardly over the back side of rear section 20 of the housing. Side walls 48 depend downwardly over the outsides of side wall sections 22 and 24 of the housing. A

brace portion 50 of the cover spans cavity 18 across open mouth 18a thereof. Cover 14 is mounted to housing 12 simply by pushing the cover downwardly in the direction of arrow "A" (FIG. 1). Rear wall 46 and side walls 48 of the cover have mounting apertures 52 which "snap" into latching engagement with a plurality of chamfered latch bosses 54 on the outsides of rear section 20 and side wall sections 22 and 24 of the housing.

The switching system of connector 10 is embodied in a first switch terminal, generally designated 56; a second switch terminal, generally designated 58; and a third switch terminal, generally designated 60. All of the switch terminals are stamped and formed from conductive sheet metal material. First switch terminal 56 includes a generally planar body portion 62 having a soldering tab 64 bent outwardly from the bottom edge thereof. An elastic contact arm 66 projects generally horizontally from one side of the body portion. A pair of barbs 68 project outwardly from opposite side edges of the body portion. A locking opening 70 is stamped in body portion 62 and extends along the body portion through a juncture between the body portion and soldering tab 64. A locking tab 72 is stamped and bent from a top edge of body portion 62 and is bent outwardly thereof.

First switch terminal 56 is mounted into side wall section 22 of housing 12 by pushing the switch terminal downwardly in the direction of arrow "B" (FIG. 1) to force planar body portion 62 into narrow retaining slot 30. The terminal is pushed downwardly until locking opening 70 moves over locking boss 39 and body portion 62 of the terminal moves into the locking space or slot 39a behind the boss. The terminal, therefore, is prevented from pulling outwardly of side wall section 22. When the body portion seats behind the locking boss, soldering tab 64 will be in position to be flush with and solderable to the circuit board. Barbs 68 at the side edges of body portion 62 bite into the plastic material of the housing within retaining slot 30. Still further, as terminal 56 is pushed downwardly into slot 30, locking tab 72 will snappingly engage behind a pair of locking shoulders 74 on side wall section 22 to prevent the body portion from pulling upwardly of the side wall section.

Second switch terminal 58 is generally L-shaped and includes an L-shaped body portion 76 and first and second elastic contact arms 78 and 80 which extend at a right angle to each other. A soldering tab 82 projects outwardly from a bottom edge of the body portion. Barbs 84 project outwardly from opposite edges of the body portion. Like switch terminal 56, body portion 76 of switch terminal 58 includes a locking opening 85 which extends along the body

portion through a juncture between the body portion and soldering tab 82. Second switch terminal 58 is mounted onto housing 12 in the direction of arrow "C" (FIG. 1) so that the L-shaped body portion 76 is pushed into narrow slots 32 and 34 of the housing, until soldering tab 82 is flush with the circuit board. As switch terminal 58 is pushed downwardly, locking opening 85 moves over locking boss 39 on the outside of the respective mounting post 22a, and body portion 76 moves into locking space or slot 39a behind the boss. This prevents switch terminal 58 from pulling outwardly of side wall section 22. Barbs 84 bite into the plastic material of the housing within slot 32.

Third switch terminal 60 includes a body portion 86 mounted into narrow slot 36 in rear section 20 of the housing. An elastic contact arm 88 projects from the body portion and is cantilevered into cavity 18 at the rear thereof. A soldering tab 90 projects outwardly from the bottom of body portion 86 for soldering to the circuit board.

Soldering tabs 64 and 90 of switch terminals 56 and 60 may be connected, as by soldering, to appropriate signal circuit traces on the printed circuit board. Soldering tab 82 of switch terminal 58 may be connected, as by soldering, to a ground circuit trace, for instance, on the printed circuit board.

FIG. 4 shows the relative proximity of elastic contact arm 80 of switch terminal 58 and elastic contact arm 88 of switch terminal 60. It can be seen that these two elastic contact arms are cantilevered into cavity 18 at the rear thereof and are normally maintained in a spaced condition until a memory card is inserted completely into the cavity. When fully inserted, a front edge of the memory card will engage elastic contact arm 88 and push the contact arm rearwardly in the direction of arrow "D" until the contact arm engages elastic contact arm 80 of switch terminal 58. This will close a circuit and allow the memory card to function in its writing or reading capacity via connector 10. Such a switch as afforded by contact arms 80 and 88 of terminals 58 and 60, respectively, often are called end-of-position switches or card detection switches.

FIG. 4 also shows the relative proximity of elastic contact arm 78 of switch terminal 58 and elastic contact arm 66 of switch terminal 56. It can be seen that the elastic contact arms are out of engagement in a normally open condition in the absence of a memory card in cavity 18. These elastic contact arms of switch terminals 56 and 58 form a write-protection switch for connector 10.

Specifically, in a write-enable condition the memory card will push elastic contact arm 78 in the direction of arrow "E" and into engagement with elastic contact arm 66 for electrically connecting the two elastic contact arms. Therefore, signals are enabled to be transmitted between the memory card and the printed circuit board.

5 In a write-inhibit condition, the memory card will have a void or recess aligned with a contact portion 78a of elastic contact arm 78 so that the elastic contact arm 78 will not engage elastic contact arm 66. With the two elastic contact arms separated, signals are inhibited from being transmitted between the memory card and the printed circuit board.

10 FIG. 3 shows how first switch terminal 56 is positively locked to side wall section 22 of housing 12. Specifically, the switch terminal cannot move downwardly in the direction of arrow "E" because body portion 62 of the terminal is engaged with the locking boss 39 within locking space 39a (FIG. 1) behind the boss which, also, prevents the body portion and switch terminal from pulling outwardly of the side wall section. The terminal cannot move upwardly in the direction of arrow "F" because of the interengagement of locking tab 72 on the terminal behind
15 locking shoulders 74 on the side wall section. Finally, the switch terminal cannot move in a forward or backward direction generally parallel to the printed circuit board because barbs 68 bite into the plastic material of the housing within retaining slot 30. Therefore, it can be seen that switch terminal 56 is positively locked in all directions, in a fixed, rigid position to prevent any loosening of the terminal when the memory card is repeatedly inserted into and pulled out of
20 cavity 18 of the connector. Switch terminal 58 also includes a locking opening 85 which is interengaged behind a locking boss 39, and switch terminal 58 also has locking barbs 84, all of which function as described above.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and
25 embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.